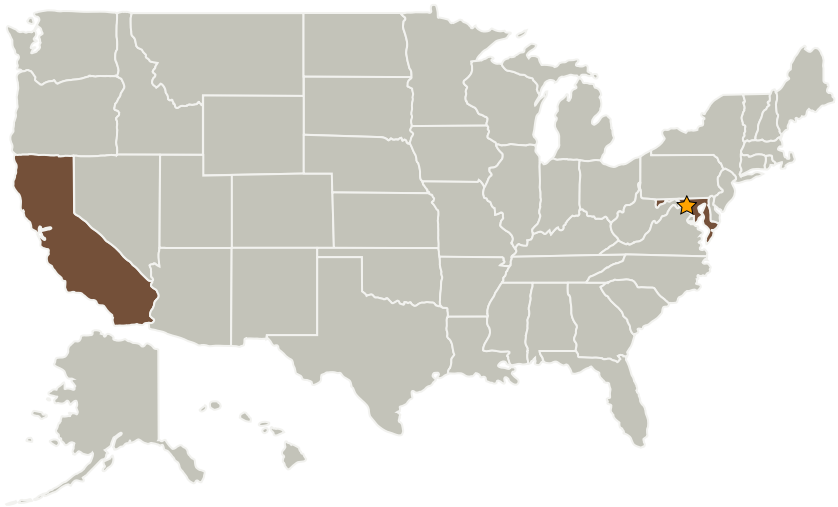
Fault Tolerant, Radiation hard DSP, Phase I

Completed Technology Project (2005 - 2005)

Project Introduction

Commercial digital signal processors (DSP) are problematic for satellite computers due to damaging space radiation effects, particularly single event upsets (SEU) and functional interrupts (SEFI). Space Micro has developed innovations for mitigating SEU and SEFI errors, enabling the use of very high-speed commercial DSPs with improved SEU tolerances (>1E-4 unrecoverable errors/day). Time-Triple Modular Redundancy (TTMR) is a method of applying traditional triple modular redundancy on a single processor, exploiting the VLIW class of parallel processors. SEFI is solved by a Hardened Core circuit, external to the microprocessor, which monitors the "health" of the processor, and when SEFI occurs, forces the processor to return to performance through a series of escalating events (interrupts, reset, etc). In Phase I we apply these technologies to COTS DSPs and also will extend the TTMR and Hardened Core architecture to reconfigurable FPGA arrays, with dramatically improved SEU/SEFI rates for Xilinx FPGAs. In Phase II we will provide SEU & SEFI hardened DSP plus FPGA product, with performance of 8,000 MIPS fixed point and 1.8 GFLOPS floating point (derated approximately 50% for improved SEU performance) while consuming less than 2 watts power, combined with an array of Xilinx reconfigurable FPGAs, providing approximately 7500 MFLOPS per FPGA.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
Space Micro, Inc.	Supporting Organization	Industry	San Diego, California

Primary U.S. Work Locations	
California	Maryland

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

David Czajkowski

Technology Areas

Primary:

- TX02 Flight Computing and Avionics
  - TX02.1 Avionics Component Technologies
    - TX02.1.3 High Performance Processors